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### Experts sure of 1 thing: It's dry here

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"It's been an astonishing winter," says Belgrade native Kelly Redmond, a climate scientist at the Desert Research Institute in Reno, Nev.

Not since the winter of 1940-41 has the West's weather been so sharply divided. The Southwest has been lashed by storm after storm, with flooding in Las Vegas, lush fields of wild flowers in Death Valley and pieces of California falling into the ocean.

Meanwhile, south-central Montana and north-central Wyoming settled in as the driest area of the continental United States. Snow fell grudgingly across the Northwest. Snowpack is down to 25 percent of normal in the Olympic Mountain Range west of Seattle. Montana's Northern Rockies have less than 60 percent of normal snow in the mountain reservoirs that feed streams all summer long.

Redmond pulls out precipitation maps and notes that the closest comparison is the winter 64 years ago. That long-ago winter could be explained by a strong El Nino that warmed Pacific waters off the coast of South America and played havoc with the weather. This year, the El Nino is so weak it's hardly an El Nino at all, and it's about as far out in the Pacific as an El Nino can get, Redmond said.

So what explains the "astonishing" winter of 2004-2005?

"That's a really big puzzle," he said. "We really don't know what is causing it."

It's part of a larger puzzle that scientists attending the annual meeting of the Consortium for Integrated Climate Research in Western Mountains this week are trying to piece together. More than 100 experts from around the country and Canada are meeting at Chico Hot Springs to share their latest research and ask for ideas from their colleagues in other disciplines.

Almost all the experts invited to make presentations assume that the world is in the midst of climate change and that everyone will feel its effects in some way. The scientists are in agreement that the planet, and most noticeably the Northern Hemisphere, is warming. But as the climate changes, there is evidence for both a drier and a wetter American West.

Many scientists say they just don't know how it will unravel.

#### Warming trend

Phil Mote of the University of Washington said that whether the precipitation increases or decreases may not matter as much in the long term as the rise in temperature itself. Warming temperatures pushed peak spring snowmelt ahead two to four weeks between 1916 and 1997 in some areas, he said. Summer streamflows are dropping earlier. Early runoff and higher summer temperature deplete soil moisture, he said.

"We don't know where precipitation is headed," Mote said. "But temperatures are going up. Temperature is the main factor in hydrology, so we're in trouble."

The fate of mountain snows as the West warms will have critical impact on replenishing groundwater, which many cities in the West use as their primary water source, said Sam Earman of the Desert Research Institute. Groundwater also provides the base level for streamflows, keeping streams running long after the snowmelt has washed into the oceans.

Even if summer rains increase, the bottom line is that rain can't recharge the groundwater the way snowpack can, Earman said. If mountain climates warm and the snow line moves further up the slopes, there will be less

snow water to recharge groundwater, he said.

Scientists talked of water conflicts pitting one state against another, of fierce forest fires and earlier growing seasons. But mostly they talked about how to measure climate change, how to explain it and how to respond to it. Scientists in fields from groundwater to tree rings, climatologists and ecologists shared their knowledge and their theories.

"It's necessary to gather information from a lot of other issues to get a long-term picture," Redmond said. "We're kind of into short attention span. We can't afford short attention span."

### **More information**

The urgency of collecting all the data is especially strong in the West, which is warming faster than the East, he said.

And nowhere is it warming faster than in the mountains. Models show that during the next 50 years, temperatures will increase in the West, and snowpack in the coastal ranges may decline as much as 50 percent, according to Ruby Leung of the Atmospheric Sciences Technical Group at Pacific Northwest National Laboratories in Richland, Wash. The Northern Rockies could lose 30 percent of its snowpack.

Leung said models show more summer heat waves and reduced air quality.

Tom Whitham, of the Department of Biological Sciences at the University of Northern Arizona, said prolonged droughts are likely to be "evolutionary events." In research conducted during drought in the Southwest, the mortality of pinon pine in the study was almost total. The few pinon that survived were genetically different from those that died, he said. Nature was selecting for drought. It's possible that the genetic survivors will replace entirely the genetic stock of those that perished, he said.

All the experts agreed that they don't have enough data. Many discussed plans for new studies of weather, groundwater, plant life and climate history.

While much of the talk centered on drought, Redmond said he doesn't know if it's set in for the long haul.

"There is no basis to assume it will continue," he said in an interview with The Gazette. "It wouldn't surprise me if it did. It wouldn't surprise me if it ended tomorrow. We don't know what's behind it, so we can't say when it will end."

New technology combining data of all kinds into computer models is only now exceeding the ability of statistical forecasts to predict what will happen next, Redmond said. Computer modeling is experimental right now, he said, so its accuracy is still in doubt.

Unfortunately for Montana, the models show continued dry weather.

"Look on the bright side," he said. "They could be wrong."